

SUMMARY OF POPULATION MONITORING OF
RIO GRANDE SILVERY MINNOW
(26-28 June 2001)

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Annotated field notes are based on provisional data that is subject to change

The third sampling effort for the 2001 Rio Grande silvery minnow population monitoring program was conducted between 26-28 June 2001. A total of 19 sites were sampled. Five sites were located in the Angostura Reach, five sites in the Isleta Reach, and 9 sites in the San Acacia Reach. During previous sampling efforts in February and April of 2001, two new San Acacia reach collection sites (10 and 11 miles downstream of the San Marcial railroad crossing) had been temporarily added to provide coverage for the lowest portion of the Middle Rio Grande. The close proximity of these sites did not provide additional resolution for this reach, however, and so the upper site (10 miles downstream of San Marcial railroad crossing) was not sampled during this monitoring effort and will not be included in future efforts. A list of collection localities is appended and listed as Table 1.

Fish were obtained by rapidly drawing a 3.1 m x 1.8 m small mesh (5 mm) seine through discrete mesohabitats. All Rio Grande silvery minnow were counted, identified to age-class, and released at the site of capture. All other fish from each seine haul were preserved in the field in 10% formalin and then returned to the Museum of Southwestern Biology - Division of Fishes for later processing and identification. Specimens are transferred from 10% formalin to water after several weeks and then, after several days, transferred to 50% alcohol prior to being sorted.

Summary of population monitoring efforts by site

The first area sampled during this collection effort was just downstream of Angostura Diversion Dam [RM 209.7] and was made on 26 June 2001. Substrate consisted primarily of silt, sand, and cobble. Water temperature at this site was relatively warm (20.0°C at 09:30). The water level was moderately high and resulted in the creation of several backwaters. No side channels were present and pools were rare. Shoreline habitats and backwaters produced the majority of individuals collected. Fish were collected in every seine haul and the catch was numerically dominated by red shiner (*Cyprinella lutrensis*) and white sucker (*Catostomus commersoni*). No Rio Grande silvery minnow (*Hybognathus amarus*) were collected at this site.

Our second collecting locality was at the NM State Highway 44 bridge crossing [RM 203.8] and was also sampled on 26 June 2001. Substrate consisted primarily of silt, gravel, and cobble. The river was highly braided with a multitude of instream habitats. Water visibility was 0.26 m. Nearly all seine hauls produced fish (17 of 18). Shallow low velocity habitats yielded many young-of-year (YOY) white sucker and western mosquitofish (*Gambusia affinis*). The majority of fishes captured were associated with shoreline habitats. Red shiner (n=123) and white sucker (n=215) were the most abundant fishes collected; all other taxa were represented by <20 individuals. No Rio Grande silvery minnow were collected.

The next site sampled on 26 June 2001 was just upstream of the Rio Rancho wastewater treatment plant [RM 200.0]. Water temperature at this site was warmer than that encountered upstream (23.5°C at 12:35). A large number of individuals representing 14 species were collected from this site. White sucker was the most frequently collected species at this site (n=317). However, the most notable discovery at this sampling locality was the presence of a large number of Rio Grande silvery minnow (n=188). All individuals collected were Age-0 and were found primarily along the shoreline and in side channels. A few individuals were even collected in main channel runs. Rio Grande silvery minnow were collected in over half of the seine hauls made at this site.

Sampling at the Central Avenue (US Highway 66) bridge crossing [RM 183.4] was completed on 26 June 2001. Substrate consisted primarily of sand and silt. Some gravel bars were present in the mid-channel areas. Most of the fish collected were in pools and found primarily along the shoreline. Backwater habitats produced many western mosquitofish and a few largemouth bass (*Micropterus salmoides*). Fish were present in most seine hauls (16 of 20) and a few Rio Grande silvery minnow (n=3) were present.

The Rio Bravo Boulevard bridge crossing [RM 178.3] was sampled on 27 June 2001. Water temperature was 20.0°C at 07:50. A number of different pool/run habitats were present throughout the site. Recent high flows at this site resulted in the creation of a large sand shelf that extends into the middle of the river channel. Most fish were collected along the shoreline and in a side channel along the east side of the river. Fewer fish were collected at this site than at upstream sites. The most commonly collected taxa were white sucker and western mosquitofish. Age-0 Rio Grande silvery minnow were present but uncommon.

The most upstream site in the Isleta Reach was the Los Lunas Bridge [RM 161.4] and was sampled on 27 June 2001. The substrata consisted of silt and sand at this and all remaining downstream sites. Aquatic habitats at this site were primarily main and side channel runs and pools. The river was quite braided and habitat heterogeneity was high. The most commonly collected species were red shiner (n=258), fathead minnow (*Pimephales promelas*) (n=219), and western mosquitofish (n=161). Rio Grande silvery minnow were present in 8 of 18 seine hauls and were moderately abundant (n=41).

Catch at the Belen Site [RM 151.5] on 27 June 2001 was numerically dominated by YOY fathead minnow. Additional abundant species were red shiner, common carp (*Cyprinus carpio*), and western mosquitofish. Rio Grande silvery minnow (n=24) were present in 6 of 18 seine hauls and some individuals were nearly 30 mm SL. Despite moderate/high flows, the river was quite braided throughout this section of the river.

Aquatic habitat at the Transwestern Pipeline Crossing [RM 143.2] was relatively homogenous but several small side channels and backwaters did provide lower water velocity habitats. This site was sampled on 27 June 2001. Most of the fish were taken in pools or in association with shallow habitats provided by sand islands. Fathead minnow were the most abundant fish taken followed by red shiner and western mosquitofish. Moderate numbers of Rio Grande silvery minnow (n=53) were taken in a wide variety of habitats, including main and side channel runs. This species (silvery minnow) was present in 13 of 17 seine hauls.

The U.S. Highway 60 Bridge site [RM 130.6] was sampled on 28 June 2001. The river channel at this locality was relatively wide and presented a variety of habitats to sample. Water visibility was greatly reduced (0.08 m) compared with upstream sampling sites. Several large backwaters were also present and yielded large numbers of fish. The most commonly collected species in backwaters included red shiner, fathead minnow, and western mosquitofish. Rio Grande silvery minnow were present in 8 of 19 seine hauls and primarily occupied areas in or near low-moderate current.

The sampling locality 3.5 miles downstream of Bernardo [RM 127.0] was also sampled on 28 June 2001 and was composed of relatively diverse habitats. Flow was confined primarily to the east side of the river. Large numbers of fathead minnow (n=505) and western mosquitofish (n=1,040) were found throughout the site. A few backwaters produced large numbers of fish. Rio Grande silvery minnow were found in 8 of 19 seine hauls and were moderately abundant (n=51).

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The site immediately downstream of San Acacia Diversion Dam [RM 116.2] was sampled on 27 June 2001. There were a wide variety of habitats available and fish were present in moderate to high densities in all habitats. Large numbers of red shiner ($n=776$) and Rio Grande silvery minnow ($n=243$) were collected as this sampling locality. Other taxa were not nearly as abundant as these taxa at this site. Relatively high numbers of Rio Grande silvery minnow were found in a wide variety of habitats and in the majority of seine hauls. It was unusual to find YOY Rio Grande silvery minnow in high velocity mesohabitats including main channel runs and riffles. Many individuals were present in runs and pools at the base of cascading flows that plummeted off the skirt of San Acacia Diversion Dam and over rip-rap. The high concentration of YOY Rio Grande silvery minnow at the base of this diversion dam may suggest recent upstream movement that was blocked at this point.

Habitat at the site 1.5 miles downstream of San Acacia Diversion Dam [RM 114.6] was composed primarily of main channel runs and some side channels. Substrate composition at this site appears to be changing from silt/sand to sand/gravel over the past year. Sampling efforts were conducted at this site on 27 June 2001. Red shiner was the most abundant fish at this site ($n=547$). Moderate numbers of Rio Grande silvery minnow ($n=64$) were collected in shoreline habitats and in 10 of 15 seine hauls.

Sampling was also conducted on 27 June 2001 at a site just upstream of the Socorro wastewater treatment plant [RM 99.5]. There was a wide variety and quantity of aquatic habitats available at this site. Recent decreased in stream flow resulted in some lateral drying at this site. Some dessicated channel catfish (*Ictalurus punctatus*) and western mosquitofish were present at the low points of several of these pools. Rio Grande silvery minnow were present in the majority of seine hauls and were found in nearly all mesohabitat types sampled.

The next downstream site (ca. 4 miles upstream of U.S. Highway 380 Bridge [RM 91.7]) was also sampled on 27 June 2001. Water was moderately turbid and extensive braiding of the river channel had recently occurred following declining stream flows. Fish were present in all habitats sampled and the most numerous taxa were western mosquitofish ($n=388$), red shiner ($n=277$), and Rio Grande silvery minnow ($n=208$). River carpsucker (*Carpionodes carpio*; $n=156$) was present in larger numbers than observed at other sampling sites.

Sampling at the US Highway 380 bridge crossing near San Antonio, NM [RM 87.1] was conducted on 27 June 2001. Most of the flow was confined to a single channel although some small and widely spaced backwaters and side channels were present. The catch was numerically dominated by western mosquitofish ($n=307$) and red shiner ($n=220$). Rio Grande silvery minnow were present but were not as abundant ($n=25$) as they were at other sampling localities.

On 26 June 2001, we sampled the Rio Grande about 5 miles (in the middle) south of the northern boundary of the Bosque del Apache National Wildlife Refuge [RM 79.1]. The river was confined to the east shoreline leaving the west bank exposed. Large numbers of YOY red shiner ($n=1,198$) were collected in several backwaters. Moderate numbers of Rio Grande silvery minnow ($n=97$) were present in nearly all habitats sampled. The presence of YOY Rio Grande silvery minnow in areas of current was also noted.

The San Marcial Railroad Bridge Crossing site [RM 68.6] was also sampled on 26 June 2001. The habitat available at this site was primarily main channel runs with shoreline habitats. Several large backwaters produced large numbers of fish. The mostly commonly collected species was Rio Grande silvery minnow ($n=298$) followed by red shiner ($n=266$). The majority of Rio Grande silvery minnow were associated with shoreline pools adjacent to flow.

The site at the former confluence of the Low Flow Conveyance Channel and Rio Grande [RM 60.5] was sampled on 26 June 2001. A few isolated pools were present at this site but fishes seemed to move out of these areas before becoming stranded. Common carp were the most frequently collected taxon (n=371) followed by western mosquitofish (n=129). The density of Rio Grande silvery minnow was much lower at this site than at upstream sampling localities. It was unusual to capture Age-0 Rio Grande silvery minnow in areas of current.

The downstream most site [RM 57.7] was also sampled on 26 June 2001. There was a notable amount of debris present at this site. Several deep backwaters produced the majority of the total catch. Common carp were again the most abundant fish species (n=305) followed by red shiner (n=58). The density of Rio Grande silvery minnow taken at this locality was fairly low (n=9). Other species present were not abundant (i.e., <40 individuals).

Discussion

There are different types, degrees, and levels of confidence that can be ascribed to information gleaned from Rio Grande silvery minnow population monitoring samples. In addition to the aforementioned factors, these data are most valuable and informative when viewed collectively and in sequence rather than individually. No where is this more important or evident than for samples taken during June, August, and October. Much as notes on a stave of a musical score, the individual interpretation from samples can be quite different from that of the collective suite.

Rio Grande silvery minnow population monitoring efforts conducted during the month of June provide an initial overview of the level and success spawning by this and other spring-reproducing Rio Grande fish species. The August population monitoring samples provide a depiction of the survival of fish that resulted from the spring spawn. Ultimately, the October sample best depicts the population structure of the fish community. October population monitoring provides the best assessment of results of the previous springs spawning effort and a first evaluation of the population demographics for the following year. The October effort also renders the first reasonable evaluation of the cohort that will be available for spawning during the upcoming spring.

The following observations should be considered with the aforementioned cautionary notes in mind. The June 2001 Rio Grande silvery minnow population monitoring samples yielded Rio Grande silvery minnow at 17 of 19 sampling localities. This species was present in each of the three reaches and was taken at all 17 sites from Rio Rancho downstream. The two most upstream sampling localities (Angostura and Bernalillo) were the only sites that did not produce silvery minnow. As expected, more than 99% of the Rio Grande silvery minnow taken during June were the product of the 2001 spawn (=Age-0 fish).

Collection of Rio Grande silvery minnow in the Angostura Reach was numerically dominated by the Rio Rancho site. Of the 193 silvery minnow collected in this reach, over 97% were taken at Rio Rancho. Conversely, silvery minnow distribution was relatively even throughout the Isleta Reach. In the San Acacia Reach, the lowest catch of Rio Grande silvery minnow was at the downstream most site which is about 19 miles below the San Marcial Railroad Bridge Crossing (Site 19). Three sites in the San Acacia Reach yielded more than 200 specimens each (San Acacia, 4 miles upstream of U.S. Hwy 380, and San Marcial Railroad Bridge Crossing). The other five sites in this reach produced between 24 and 97-Rio Grande silvery minnow. Finally, the San Acacia Reach was the only portion of the river that yielded any Age-1 or older silvery minnow.

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These preliminary data suggest that the 2001 spawn of Rio Grande silvery minnow was relatively good especially compared to 2000. The presence in 2001 of a near normal snow-pack in the headwaters of the Rio Grande provided for a spring-runoff of considerably greater volume, duration, and magnitude than occurred in 2000. The May 2001 collection of Rio Grande silvery minnow eggs at downstream locations was the first indication of a relatively good spawn by this species. There was no attempt to collect Rio Grande silvery minnow eggs in either the Angostura or Isleta reaches.

The increased 2001 reproductive effort of Rio Grande silvery minnow can be attributed to multiple factors. The foremost component responsible for this success was maintenance of flow throughout the Rio Grande in 2000. Retention of water in the Isleta Reach was certainly responsible for some of the Age-0 silvery minnow collected there and in the San Acacia Reach in 2001. Likewise the continuous flow in the San Acacia Reach during 2000 allowed the survival of a breeding stock of Rio Grande silvery minnow for reproduction during the 2001 spawning season. The importance and magnitude of the conservation efforts during 2000 toward the continued existence of a natural population of this endangered fish cannot be over stated.

Understanding the occurrence of Age-0 Rio Grande silvery minnow in the Angostura and Isleta reaches, in light of the apparent lack of adults, is easily explained. The misconception most in need of eradication is that the absence of adult Rio Grande silvery minnow in a specific reach during an annual population monitoring effort is tantamount to the extirpation of that species from that reach. This fallacious assumption is understandably made by those uneducated in the ecological fields but is indefensible when made by persons purported to be trained in a biological discipline.

Some explanation of the limitations of samples may prove beneficial and aid in avoiding future confusion. A "sample" represents a very small portion of a population. The rarer an item, the less likely that it will be represented in the sample. Conversely, the more common an item, the more likely that it will comprise a significant portion of the sample. Means of attempting to make sure that uncommon organisms are represented in samples are to increase the number of samples taken or increase the size of each sample. Ultimately the size and number of samples necessary to for a reasonable assurance of inclusion of rare items may become impractical, especially as one nears the process of sampling the entire population (which is the only means to ensure complete representation). At that juncture (sampling the entire population), it is no longer a sample of the population but instead an inventory of the population.

The Angostura and Isleta reaches of the Rio Grande were intensely sampled as part of the 2000 Rio Grande silvery minnow population monitoring effort with only two silvery minnow collected in the former reach and four in the latter reach. These numbers were indicative of the rarity of this species. These data did not mean that only six Rio Grande silvery minnow occurred upstream of San Acacia. During a supplemental sampling effort (not part of the Rio Grande silvery minnow population monitoring study) about 250 Rio Grande silvery minnow were collected in a single pool near Los Lunas. It would have been illogical to assume that the only school of Rio Grande silvery minnow in the Isleta Reach had just been captured. A more reasonable hypothesis was that there were several additional schools of silvery minnow in the Isleta Reach and likewise in the Angostura Reach. Attempting to predict the number of hypothesized schools in either reach would not have been defensible. Ultimately, the 2001 collection of Age-0 Rio Grande silvery minnow in the Angostura and Isleta reaches provides the strongest support for the above assumptions.

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In May and June 2000, a total of about 200,000 larval Rio Grande silvery minnow was released into the Rio Grande at Bernalillo (Angostura Reach) and Los Lunas (Isleta Reach). Since these fish were not marked, there was no means to determine their role, if any, in the increased number of 2001 Age-0 silvery minnow cohort in the Angostura and Isleta reaches. The array of possibilities that the stocked fish could have had on the population ranges from failing to survive reintroduction to being totally responsible for all 2001 Age-0 Rio Grande silvery minnow in these two reaches. While the former is considerably more likely than the latter, studies other than population monitoring will be required to answer that question.

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Table 1. Collection localities for 2001 population monitoring of Rio Grande silvery minnow.

Site #	Site Locality
ANGOSTURA REACH SITES	
0	New Mexico, Sandoval County, Rio Grande, below Angostura Diversion Dam, Angostura. River Mile 209.7 SAN FELIPE PUEBLO QUADRANGLE 3916006 N 363811 E
1	New Mexico, Sandoval County, Rio Grande, at NM State Highway 44 bridge crossing, Bernalillo. River Mile 203.8 BERNALILLO QUADRANGLE 3909722 N 358543 E
2	New Mexico, Sandoval County, Rio Grande, ca. 4 miles downstream of NM State Highway 44 bridge crossing at Rio Rancho Wastewater Treatment Plant, Rio Rancho. River Mile 200.0 BERNALILLO QUADRANGLE 3905355 N 354772 E
3	New Mexico, Bernalillo County, Rio Grande, at Central Avenue (US Highway 66) bridge crossing, Albuquerque. River Mile 183.4 ALBUQUERQUE WEST QUADRANGLE 3884094 N 346840 E
4	New Mexico, Bernalillo County, Rio Grande, at Rio Bravo Boulevard bridge crossing, Albuquerque. River Mile 178.3 ALBUQUERQUE WEST QUADRANGLE 3877163 N 347554 E
ISLETA REACH SITES	
5	New Mexico, Valencia County, Rio Grande, at Los Lunas (NM State Highway 49) bridge crossing, Los Lunas. River Mile 161.4 LOS LUNAS QUADRANGLE 3852531 N 342898 E
6	New Mexico, Valencia County, Rio Grande, ca. 1.0 miles upstream of NM State Highway 309/6 bridge crossing, Belen. River Mile 151.5 TOME QUADRANGLE 3837061 N 339972 E
7	New Mexico, Valencia County, Rio Grande, ca. 2.2 miles upstream of NM State Highway 346 bridge crossing (near Transwestern Pipeline crossing), Jarales. River Mile 143.2 VEGUITA QUADRANGLE 3827329 N 338136 E

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Table 1 (continued.). Collection localities for 2001 population monitoring of Rio Grande silvery minnow.

Site #	Site Locality
ISLETA REACH SITES (continued)	
8	New Mexico, Socorro County, Rio Grande, at US Highway 60 bridge crossing, Bernardo. River Mile 130.6 ABEYTAS QUADRANGLE 3809726 N 334604 E
9	New Mexico, Socorro County, Rio Grande, ca. 3.5 miles downstream of US Highway 60 bridge crossing, La Joya. River Mile 127.0 ABEYTAS QUADRANGLE 3805229 N 331094 E
SAN ACACIA REACH SITES	
10	New Mexico, Socorro County, Rio Grande, directly below San Acacia Diversion Dam, San Acacia. River Mile 116.2 SAN ACACIA QUADRANGLE 3791977 N 326162 E
11	New Mexico, Socorro County, Rio Grande, ca. 1.5 miles downstream of San Acacia Diversion Dam, San Acacia. River Mile 114.6 LEMITAR QUADRANGLE 3790442 N 325263 E
12	New Mexico, Socorro County, Rio Grande, 0.5 miles upstream of the Low Flow Conveyance Channel bridge, east and upstream of Socorro Wastewater Treatment Plant, Socorro. River Mile 99.5 LOMA DE LAS CANAS QUADRANGLE 3771043 N 327097 E
13	New Mexico, Socorro County, Rio Grande, ca. 4.0 miles upstream of US Highway 380 bridge crossing, San Antonio. River Mile 91.7 SAN ANTONIO QUADRANGLE 3761283 N 328140 E
14	New Mexico, Socorro County, Rio Grande, at US Highway 380 bridge crossing, San Antonio. River Mile 87.1 SAN ANTONIO QUADRANGLE 3754471 N 328914 E
15	New Mexico, Socorro County, Rio Grande, directly east of Bosque del Apache National Wildlife Refuge headquarters. River Mile 79.1 SAN ANTONIO, SE QUADRANGLE 3740839 N 327055 E

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Table 1 (continued.). Collection localities for 2001 population monitoring of Rio Grande silvery minnow.

Site #	Site Locality
SAN ACACIA REACH SITES (continued)	
16	New Mexico, Socorro County, Rio Grande, at the San Marcial railroad crossing, San Marcial. River Mile 68.6 SAN MARCIAL QUADRANGLE 3728347 N 315284 E
17	New Mexico, Socorro County, Rio Grande, at its former confluence with the Low Flow Conveyance Channel and 16 miles downstream of the southern end of the Bosque del Apache National Wildlife Refuge. River Mile 60.5 PARAJE WELL QUADRANGLE 3718178 N 309487 E
18	New Mexico, Socorro County, Rio Grande, ca. 19 miles downstream of the southern end of the Bosque del Apache National Wildlife Refuge. River Mile 57.7 PARAJE WELL QUADRANGLE 3714740 N 307380 E